

Application No. 10/561,342
Amendment dated August 3, 2010
Reply to Office Action of May 19, 2010

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Docket No.: 69495(301067)

Amendments to the Specification

Please amend the specification as follows.

On Page 6, Lines 4-5:

In the complex membrane, it is preferred that the micro-porous polyolefin membrane is a membrane having at least one layer composed of polyethylene polymer ~~and/or~~ polyethylene polymer, and the micro-porous polyolefin membrane preferably has a thickness of 5 to 50 .mu.m and a porosity of 30 to 80%.

On Page 8, Line 12:

The complex membrane for an electrochemical device according to the present invention has a micro-porous polyolefin membrane, which plays a role of supporting strength of the complex membrane. The first thing required as a strength support layer is a mechanical strength. That is to say, a perforation or puncture strength should be great in order to prevent short-circuit of anode and cathode, a tensile strength should be great to increase a battery manufacturing process rate, and a heat distortion of the membrane such as thermal shrinkage should be small. In addition, considering the stability problem such as explosion of the battery, the membrane is preferably configured as a support body to have a shutdown function so that pores may be closed at a specific temperature. Here, the term 'shutdown function' is a means for controlling thermal runaway which may be caused by physical damage of the battery, short due to internal defects or overcharging, or the like. By using the shutdown function, most of the pores are closed at a specific temperature (90 to 120°C.), thereby blocking ion or current flow. As a material for forming the membrane

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capable of accomplishing such function, polyolefin polymer is suitable. For example, a PP/PE/PP membrane is provided with the shutdown function since a PE layer is melted at a specific temperature to close pores. Polyolefin polymer suitable for the complex membrane of the present invention includes polyethylene polymer and/or polyethylene polymer, and may use, for example, a porous polyolefin membrane film or nonwoven fabric, a complex composition in which the same kind of nonwoven fabric is laminated on a film, a porous polyamide membrane film or nonwoven fabric, or a porous polyester membrane film or nonwoven fabric, each having a single PE membrane, a single PP membrane, a PE/PP two-layer membrane, a PP/PE/PP three-layer membrane or a complex multi-layer structure composed of PE and PP, which is monoaxial-oriented or biaxial-oriented. Preferably, a porous polyolefin membrane film of a single PE membrane, a PE/PP two-layer membrane or a PP/PE/PP three-layer membrane, which has the shutdown function for prevention of short-circuit between both electrodes, is used. This micro-porous polyolefin membrane may be manufactured according to any conventional method disclosed in EP 1,146,577, U.S. Pat. No. 6,368,742, U.S. Pat. No. 5,691,077, U.S. Pat. No. 6,180,280, U.S. Pat. No. 5,667,911 and U.S. Pat. No. 6,080,507. As for the micro-porous polyolefin membrane of the present invention, a micro-porous polyolefin film placed on the market may be used. For example, Clegard film (PE membrane, PP membrane, PP/PE/PP three-layer membrane) of Celgard Co., Hipore film (PE) of Asahi Kasei Co., Setela film (PE) of Tonen/ExxonMobil Co., or Teklon film of Entek International Co. may be provided as a micro-porous polyolefin membrane for acting as a strength support layer.

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